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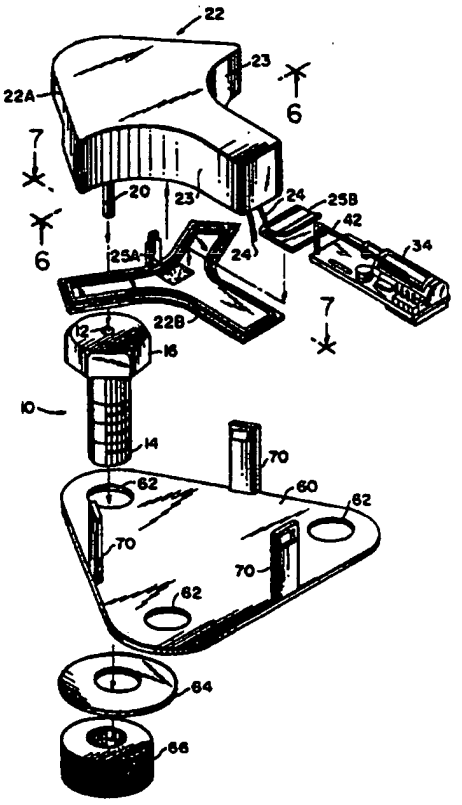
(54) Title: SMART BOLT DEVICE HAVING COMMUNICATIONS SYSTEM IN SEPARATE HOUSING FROM BOLT

(57) Abstract

A hot bearing detection system as shown which spatially separates the thermal sensor (21) which is disposed within a bearing-securing bolt (10) from the communication means (42) for communicating high temperature conditions occuring at a railroad car bearing or the like. The housing (22) for the communication means is disposed adjacent the bearing and is connected electrically with the thermal sensor such that when high temperature conditions occur the conditions will be r.f.-communicated to the wayside or to a locomotive.



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SMART BOLT DEVICE HAVING COMMUNICATIONS SYSTEM IN SEPARATE HOUSING FROM BOLT

BACKGROUND OF THE INVENTION

I. FIELD OF INVENTION

The present invention relates generally to thermal sensors that detect the failure of mechanical devices, such sensors being connected to a communication means or system for relaying the information that a pre-determined temperature has been reached. In particular, the present invention relates to a system including a thermal warning indicator that is used in place of an ordinary bolt of a railroad car wheel bearing to indicate when the temperature of the bearing has reached a level indicative of potential failure in the bearing.

II. DESCRIPTION OF THE PRIOR ART

Warning devices are typically used to indicate a condition on a railroad car bearing as exceeding a pre-determined threshold temperature, which is indicative of an approaching bearing failure. Such a warning device is necessary for the identification of bearing problems in order to avoid undesirable results, such as train derailment. A detailed discussion of such warning devices, which will serve as a background for the present invention, will be found in U.S. patent 4,812,826 to Kaufman et al, issued March 14, 1989. The warning device or system of Kaufman et al is housed within a bore formed in the

conventional wheel bearing bolt, the system including a communication means which is likewise disposed within the bolt bore.

It has been found that the sensitivity to high temperature of certain esoteric communication means, which are particularly adapted for use in the aforenoted warning devices and systems, is such that it is extremely difficult to maintain the communication means in a suitably operable state when housed within the conventional bolt. In other words, the space allowed within the bore of the bolt sometimes does not allow for sufficient heat dissipation, or for the inclusion of helpful heat insulation materials; consequently, the performance of the communication means can be severely affected.

Accordingly, it is a primary object of the present invention to overcome the aforenoted problem or problems associated with having all of the components of the warning indicator system disposed or situated in the narrow confines of the specially adapted bearing bolt, that is, within the bore of such bolt; while at the same time enabling temperature measurement to be made at a point closely adjacent the bearing so as to insure that a suitable pre-determined temperature indicative of potential failure of the bearing will be properly detected and communicated.

Another object is substantially to retain the simplicity and compactness of previously known schemes such as that disclosed in U.S. patent 4,812,826 to Kaufman et al. Yet another object is to provide a thermal warning indicator that can be readily self-

tested, i.e., an indicator that can provide an output without the need to raise the antenna which, in the prior art, occurs only when a high temperature condition exists.

An additional object is to bring the cost down for the indicator or system by not having to operate a transmitter in a confined bore space.

Further objects are to provide a temperature monitoring feature when desired; to enable field installability instead of having to install the indicator at a maintenance shop; and to be able to install the indicator on all size of railroad cars.

SUMMARY OF THE INVENTION

In fulfillment of the above stated and other objects, the critical deficiency or problem, already noted, has been overcome by recognizing that spatial separation of the components can be achieved, but yet, an essentially completely integrated compact structure for the detection system of the present invention can be realized. As a consequence, the advantage is gained that the detection and warning system of the present invention substantially reduces the temperature to which the communication components in particular are subjected by having them disposed in a separate housing readily secured to and adjacent the railroad car bearing assembly at which the temperature is to be monitored or detected. Additionally, the conventional bolt, in which a bore has been provided so that the thermal sensor may be suitably encapsulated, is used to secure the housing for the communication means. It will further be appreciated that the component least sensitive to

temperature is located deep within the bore at a point of maximum temperature such that an early warning of a high temperature condition can be detected, while the other, more sensitive, components of the system are protected.

Briefly described then, a preferred embodiment of the present invention is defined as follows. A hot bearing detection system for detection of failures of a bearing comprising: a housing and means for securing said housing adjacent the bearing, said means for securing including a bolt, said bolt having a head end and an opposite end, with a bore extending from said head end to the opposite end; a thermal sensor disposed in said bore; means within said housing for communicating a warning condition, said means for communicating including a transmitter circuit, an antenna and an energy source; and means for electrically connecting said thermal sensor to said means for communicating.

Other and further objects, advantages and features of the present invention will be understood by reference to the following specification in conjunction with the annexed drawings, wherein like parts have been given like numbers.

BRIEF DESCRIPTION OF DRAWING

Fig. 1. is an exploded view of the complete hot bearing detection system featuring a specially designed bolt for solely containing the thermal sensor, integrated with a housing for the communication means secured by the illustrated bolt.

Fig. 2. is a perspective view of the hot bearing detection system.

Fig. 3. is a fragmentary elevation view of the system, particularly illustrating the two-piece housing and the sleeve which is insertable into the bolt.

Fig. 4. is a sectional view, taken on the line 4-4 in Figure 2, of two-piece housing for housing the communication means, which include a transmitter circuit formed on a circuit board fitted within the housing, the circuit having an energy source and an antenna for communicating appropriate signals to a distant location.

Fig. 5. is a bottom plan view, taken on the line 5-5 in Figure 3, of the entire housing.

Fig. 6. is a bottom plan view, taken on the line 6-6 in Figure 1, of the top part or portion of the housing for the communication means, and showing the sleeve for the thermal sensor.

Fig. 7. is a top plan view, taken on the line 7-7 of Figure 1, of the bottom part or portion of the housing.

Fig. 8. is a block diagram of the transmitter circuit.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The preferred embodiment of the bearing detection system of the present invention is illustrated in Figures 1 through 6. In Figure 1 there will be seen a conventional bolt 10 in which a bore 12 has been created so that a thermal sensor or probe assembly 20 can be disposed adjacent the lower end 14 of such bolt, the upper or head end 16 of the bolt being in the form of an hexagonal cap. A thermal sensor 21 is disposed within the probe assembly 20 which extends downwardly toward the lower end 14, adjacent to the bottom of the bolt 10, the upper end 20A of the probe assembly 20 extending through the cap 16 and into the housing 22. The probe assembly is in the form of an L-shaped sleeve, typically made of heat resistant plastic, (see Fig. 4) in which a pair of leads 24 are extended from within the housing and into the probe assembly and thence, downwardly to connect the thermal sensor 21 within assembly 20.

Schematically depicted in Fig. 8 is a transmitter circuit 30 laid out on a circuit board 32, the circuit 30 being connected by means of the leads 24 to the thermal sensor 21. An energy source 34 provides power to the basic components of oscillator 36, modulator 38, amplifier 40. An antenna 42 is connected to the output stage of amplifier 40, together with the basic components already noted constituting a means for transmitting a signal based on the detection of a closed state by the thermal sensor responsive to the bolt 10 reaching a threshold temperature.

As seen in Figure 4, the circuit board 32 is sandwiched between the upper portion or part 22A and the lower portion or part 22B of housing 22. The upper porti n of the housing is particularly seen in Figure 6. The board is held in position by Velcro means, one piece 25A of which is affixed to the inner surface of the lower portion 22B of the housing seen in Figure 1; the other piece of Velcro 25B being formed around the board 32 for engagement with 25A. The lower portion 22B of the housing, abuts a mounting plate 60 (Figure 4) which is provided with three spaced holes 62 located at the respective apices of the triangular-shaped mounting plate or washer. The specially designed bolt 10 secures the mounting plate 60 to a wheel bearing assembly (not seen), a washer 64 and nut 66 engaging the bolt 60 for such purpose. Other conventional bolts (not seen) are passed through the other two holes to jointly secure the plate.

It will be understood that the housing 22 is confined by integral upstanding brackets 70 suitably spaced on the mounting plate 60, the mounting plate itself being secured as already noted. Inwardly directed clips 72 are provided on the brackets 70 for retaining the housing 22.

As particularly seen in Figures 5 - 7, the two pieces or parts 22A and 22B of the housing 22 are specially configured. The bottom portion 22B is injection molded in the relatively then, Y-shape configuration depicted; and the top portion, likewise molded, has a similar configuration, but with sides 23. A canopy 23 is also added to project, with a limited thickness, from the generally Y-shaped portion, thereby to shelter the sleeve 20 which is L-shaped and extends radially within a groove 26 forming part of the canopy.

In operation of the hot bearing detection system of the present invention, the situation is such that when a sufficient threshold temperature is reached within the bearing assembly context, the thermal sensor or switch 21, within the sensor assembly 20, which switch is normally in the open position will close so as to activate the input circuit of oscillator 36 of the communication means 30 (Figure 8), thereby to cause a modulated signal to be transmitted through the communication means and to be emitted by antenna 42 to the guideway of the railroad system or to a train locomotive, at which location it is discerned by an operator or maintenance person.

The invention having been thus described with particular reference to the preferred forms thereof, it will be obvious that various changes and modifications may be made therein without departing from the spirit and scope of the invention as defined in the appended claims.

CLAIMS:

1. A hot bearing detection system for detection of incipient failures of a bearing comprising:

a housing and means for securing said housing adjacent the bearing, said means for securing including a bolt, said bolt having a head end and an opposite end, and with a bore extending from said head end to the opposite end;

a thermal sensor disposed in said bore;

means within said housing for communicating a warning condition, said means for communicating including a transmitter circuit, an antenna and an energy source; and

means for electrically connecting said thermal sensor to said means for communicating.

2. The hot bearing detection system of claim 1, further comprising a circuit board on which said transmitter circuit is mounted.

3. The hot bearing detection system of claim 1, wherein said housing is constituted of a plastic material that is heat resistant.

4. The hot bearing detection system of claim 1, wherein said thermal sensor includes a switch for connecting to said transmitter circuit, said switch being normally open but, responsive to a critical temperature, changing to a closed state.

5. The hot bearing detection system of claim 1, wherein said housing is an injection molded two-piece housing and in which said circuit board is sandwiched between upper and lower pieces of said housing.

6. The hot bearing detection system of claim 1, wherein the bearing is contained within a railway car bearing assembly, and further comprising a mounting plate mounted adjacent the bearing assembly and means for retaining said housing on said mounting plate.

7. The hot bearing detection system of claim 1, wherein a thermal sensor assembly is provided in the form of a sleeve which extends from said means for communicating to within said bore, said thermal sensor being disposed within, and adjacent, the end of the sleeve.

8. The hot bearing detection system of claim 1, further comprising mounting bolts, said mounting plate being provided with holes for receiving said mounting bolts to secure said system to said bearing assembly.

9. A hot bearing detection system for detection of incipient failures of a bearing located within a bearing assembly, the system comprising:

a housing;

means for securing said housing adjacent to the bearing assembly, said means for securing including a bolt;

a thermal sensor disposed for sensing the temperature of the bearing assembly; and

means within said housing for communicating a warning condition, said means for communicating including a transmitter circuit, an antenna and an energy source;

means for electrically connecting said thermal sensor to said means for communicating.

10. The hot bearing detection system of claim 9, wherein the bearing assembly has a defined outer boundary wherein said housing is outside of said outer boundary and said thermal sensor is within said outer boundary.

11. The hot bearing detection system of claim 9, wherein said means for securing supports said housing against an outer boundary of the bearing assembly.

12. The hot bearing detection system of claim 9, wherein said transmitter circuit generates a modulated signal corresponding to said warning condition that is emitted by said antenna.

FIG.1

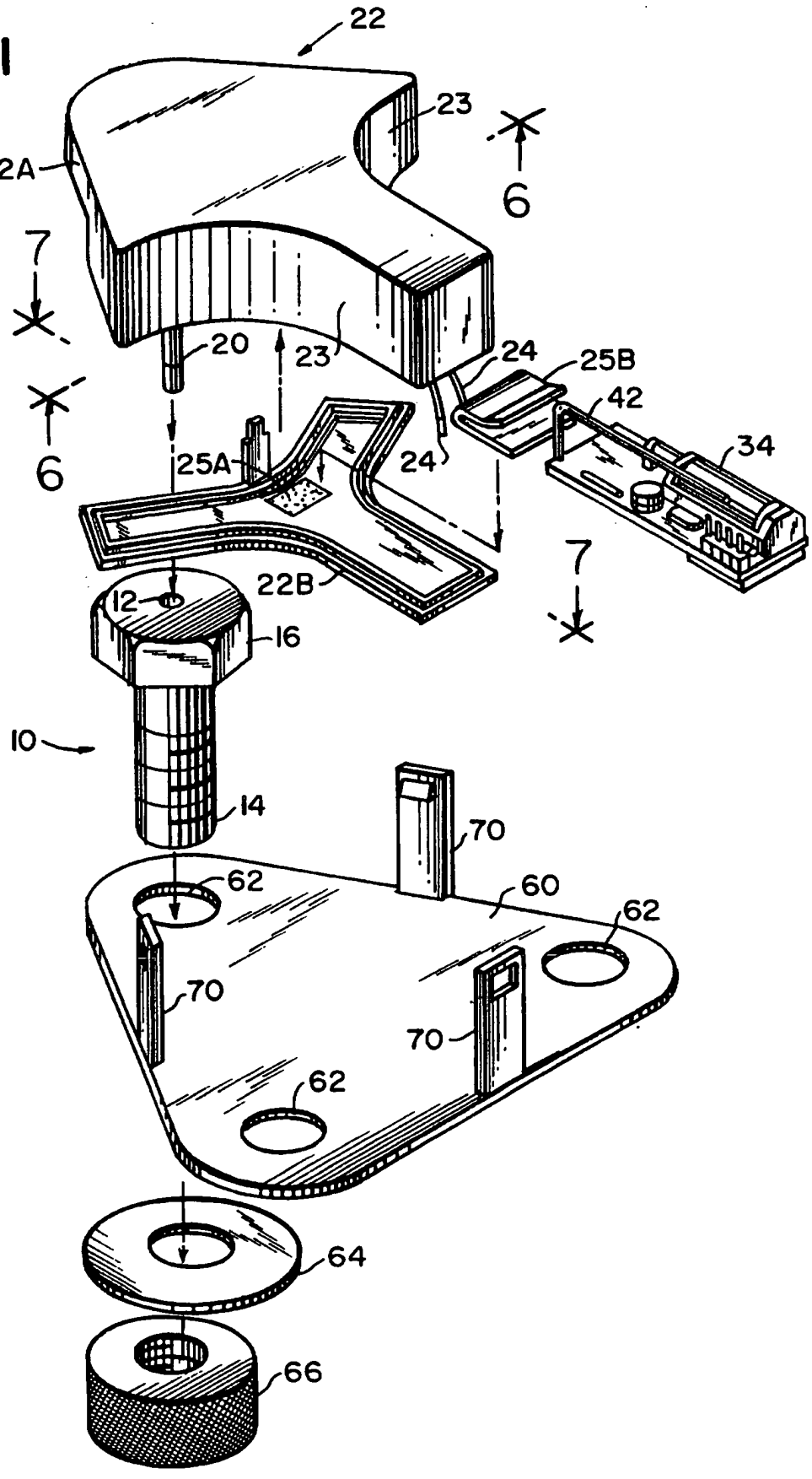

22
23
22A
6
7
20
23
24
25B
42
6
25A
24
34
7
22B
12
16
10
14
70
62
60
62
70
70
62
64
66

FIG.2

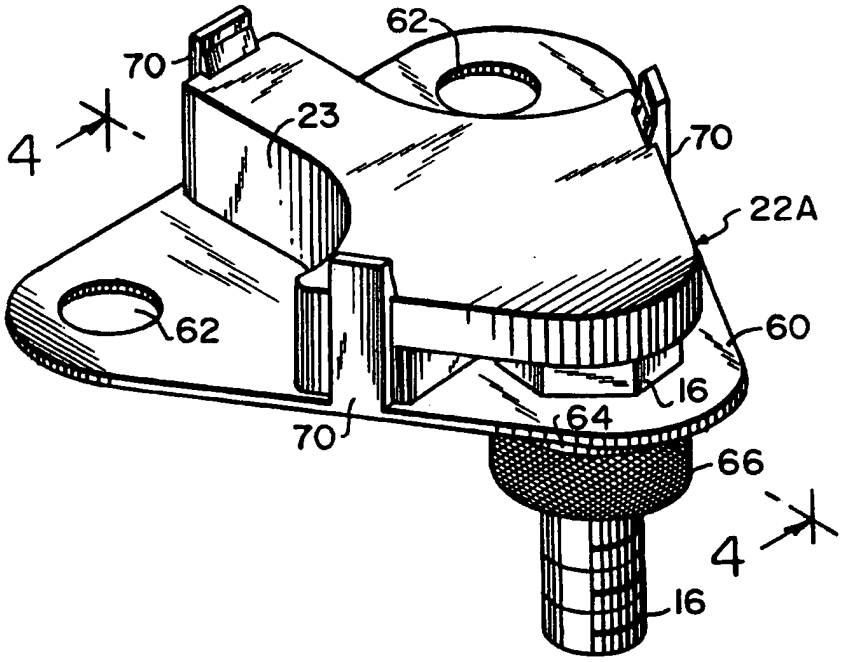
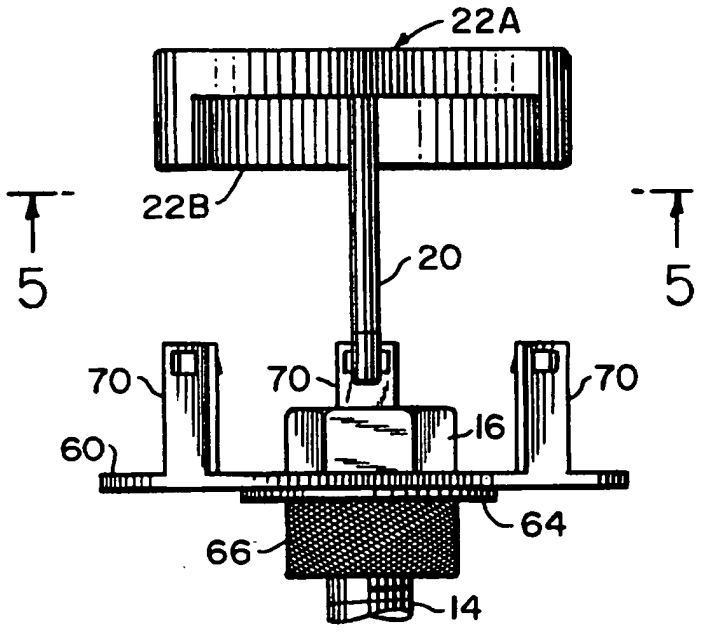

62
70
4
23
70
22A
62
60
16
64
70
66
4
16

FIG.3


22A
22B
5
5
20
70
70
70
16
60
64
66
14

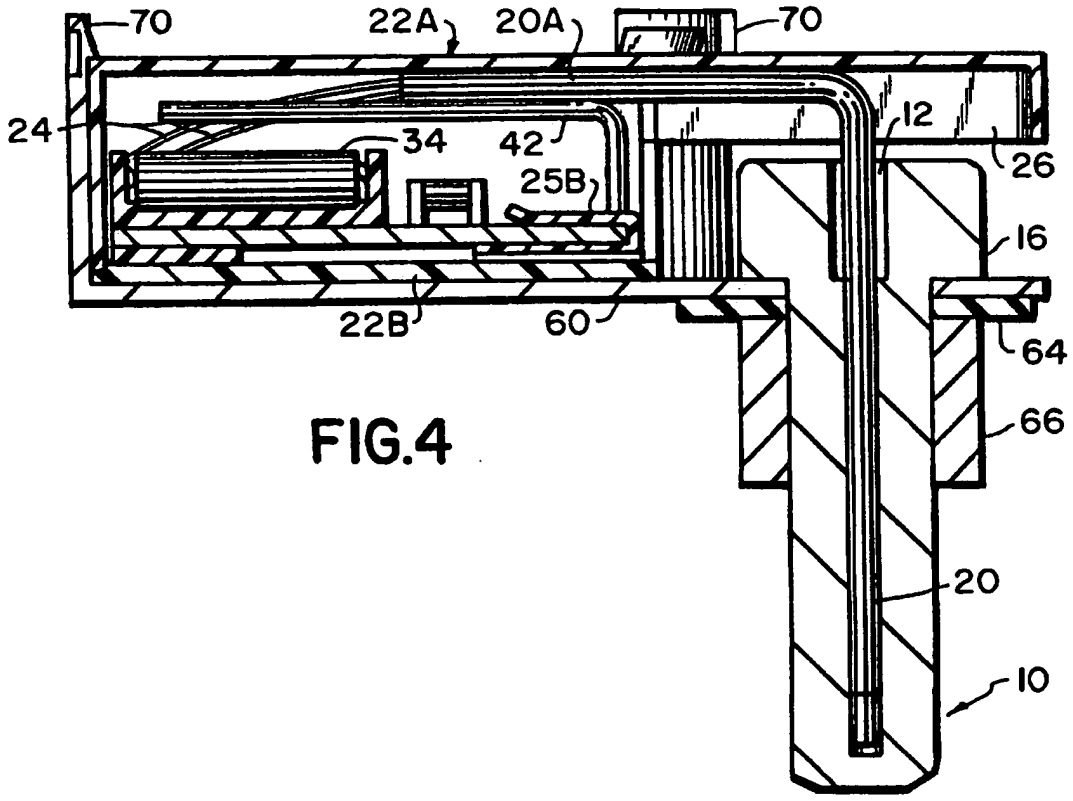

70
22A
20A
70
24
34
42
12
26
25B
16
22B
60
64
66
20
10

FIG.4

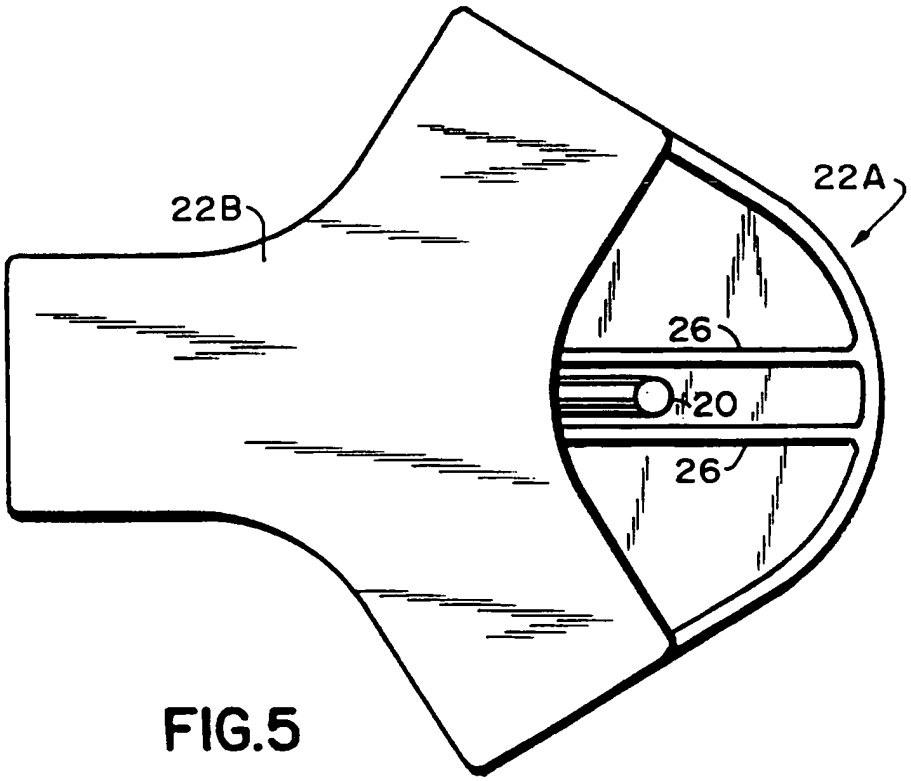

22B
22A
26
20
26

FIG.5

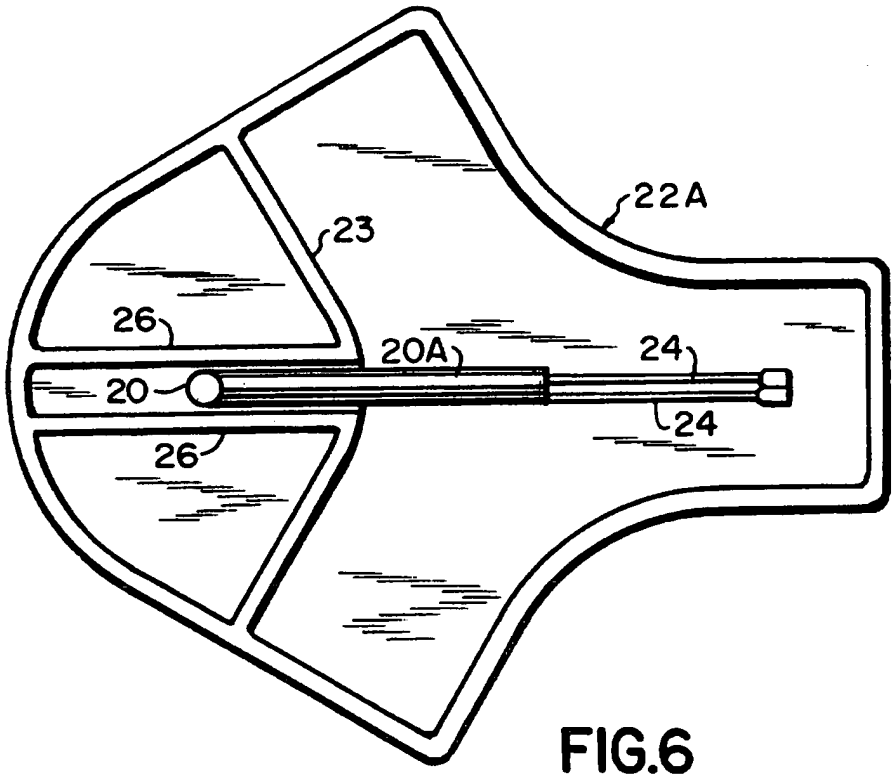


FIG.6

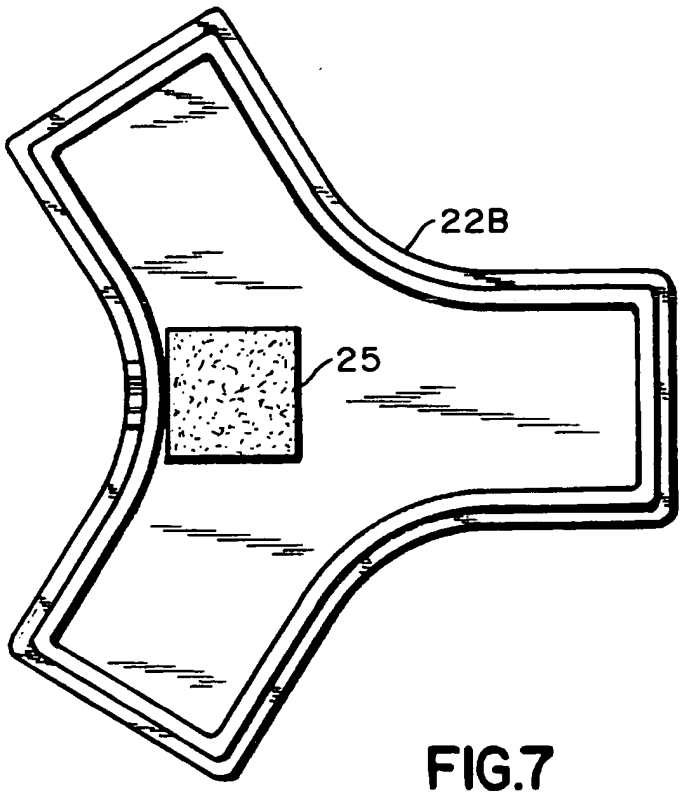


FIG.7

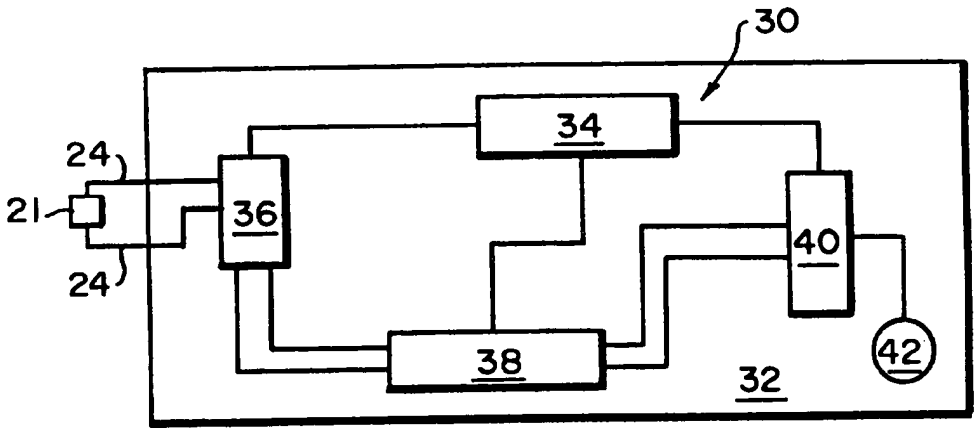


FIG.8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US95/09006

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : G08B 21/00; G01N 25/00, G01K 1/00, G01K 1/16

US CL : 340/682; 374/10, 208, 135

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 340/682; 374/10, 208, 135

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, A, 4,812,826 (KAUFMAN ET AL) 14 MARCH 1989, col. 5, line 54-col. 6, line 3.	1-8
Y	US, A, 4,340,886 (BOLDT ET AL) 20 JULY 1982, abstract	1-8
A	US, A, 4,859,076 (TWERDOCHLIB) 22 AUGUST 1989	1-8
A	US, A, 5,173,922 (ARAKAWA ET AL) 22 DECEMBER 1992	1-8
A	US, A, 4,818,119 (BUSCH ET AL) 4 APRIL 1989	1-8

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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Date of the actual completion of the international search

18 SEPTEMBER 1995

Date of mailing of the international search report

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